

CLIMATE DYNAMICS, PHD

Banner Code: SC-PHD-CLIM

Academic Advising

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Website: science.gmu.edu/academics/departments-units/atmospheric-oceanic-earth-sciences/climate-dynamics-phd

The mission of this program is to train the next generation of scientists in climate dynamics and related fields. Through a comprehensive grounding in coursework, our students learn about how the atmosphere, ocean, and land surface work together to determine the climate. In collaboration with internationally-known scientists, students conduct independent work to further our understanding of climate, how it varies, and how much of it we can predict. Tools in the program include cutting-edge climate models, superb computing facilities, sophisticated statistical techniques, and comprehensive data sets. Our graduates have gone on to work at top laboratories and universities.

Understanding climate variability and predictability poses difficult mathematical, computational, and observational questions that have generated increasing intellectual excitement in recent years. Climate variability has important ramifications for society, from planning for next year's electrical demand and forecasting agricultural production to answering complex questions involving long-term change in global climate, sea level, and biodiversity. While it is impossible to predict day-to-day weather more than a few weeks in advance, progress in predicting El Niño supports the idea that seasonal averages of temperature, rainfall, and other factors may be at least partly predictable months or even years in advance. Likewise, there is a strong scientific basis for predicting long-term changes in global climate due to changing greenhouse gas concentrations.

Climate dynamics faculty members have a blend of expertise in dynamics, statistics, and computational methods. They are heavily involved with national and international collaborations. Faculty members and students work closely with scientists at the Center for Ocean-Land-Atmosphere Studies (COLA) (<http://cola.gmu.edu/cola.html>), a national leader in climate modeling.

Faculty research focuses on the areas of climate prediction and predictability, climate variability, coupled ocean-atmosphere-land dynamics, and dynamical systems and retrospective analysis. Recent research topics include predictability of weather and climate; modeling of the complex climate system; El Niño dynamics; monsoons; atmosphere-ocean interaction; land-climate interaction; decadal climate variability; ocean circulation theory; and climate change.

This has been designated a Green Leaf program (<http://catalog.gmu.edu/student-services/green-leaf-programs-courses/>).

Admissions & Policies

Admissions

University-wide admissions policies can be found in the Graduate Admissions Policies (<http://catalog.gmu.edu/admissions/graduate-policies/>) section of this catalog. International students and students having earned international degrees should also refer to Admission

of International Students (<https://catalog.gmu.edu/admissions/international-students/>) for additional requirements.

Eligibility

Applicants should have demonstrated a high aptitude for quantitative reasoning, applied mathematics, and physical science. Applicants should have an undergraduate degree from an institution of higher education accredited by a Mason-recognized U.S. institutional accrediting agency or international equivalent with a GPA of at least 3.00 in undergraduate work.

Application Requirements

To apply for this program, prospective students should submit the George Mason University Admissions Application (<https://www2.gmu.edu/admissions-aid/apply-now/>) and its required supplemental documentation, three letters of recommendation, and a goals statement.

The GRE is not required for admission into this program.

Policies

For policies governing all graduate programs, see AP.6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/>).

Transferring Previous Graduate Credit into this Program

Previously earned and relevant graduate credits may be eligible for transfer into this program; details can be found in the Credit by Exam or Transfer (<https://catalog.gmu.edu/policies/academic/graduate-policies/>) section of this catalog.

Requirements

Degree Requirements

Total credits: 72

This is a Green Leaf program.

Students should refer to the Admissions & Policies tab for specific policies related to this program.

Fundamental Climate Science Courses

Code	Title	Credits
CLIM 610	Introduction to the Physical Climate System	3
CLIM 614	Land-Climate Interactions	3
CLIM 711	Introduction to Atmospheric Dynamics	3
CLIM 712	Physical and Dynamical Oceanography	3
CLIM 751	Predictability and Prediction of Weather and Climate	3

Total Credits 15

Core Computational Courses

Code	Title	Credits
CLIM 680 or CSI 690	Climate Data Numerical Methods	3

CLIM 715	Numerical Methods for Climate Modeling	3
CLIM 762	Statistical Methods in Climate Research	3
Total Credits		9

Climate Seminar

Code	Title	Credits
CLIM 991	Climate Dynamics Seminar (taken three times)	3
Total Credits		3

Electives

Select 21 credits of graduate-level electives, including CLIM courses and other relevant courses as approved by the graduate coordinator¹.

Code	Title	Credits
CLIM courses (http://catalog.gmu.edu/courses/clim/)		21
Total Credits		21

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Including up to 6 credits of CLIM 796 or CLIM 996.

Eligibility for Qualifying Exams

Satisfactory progress in the program is demonstrated by adequate research progress (as attested by the advisor) and by the student attaining a B- or higher in all CLIM courses and on the final exams of the "Core Climate" courses (CLIM 610 Introduction to the Physical Climate System, CLIM 614 Land-Climate Interactions, CLIM 711 Introduction to Atmospheric Dynamics, CLIM 712 Physical and Dynamical Oceanography). If any of these conditions are not met, the director of the Climate Dynamics program convenes a faculty committee to recommend whether the student should continue in the program. The director makes the final decision based upon input from the committee. A student who is allowed to continue in the program may, in a later semester, retake any Core Climate final exam in which the student's score was below B-.

To be eligible for CLIM 997 Doctoral Qualification, students must have received a B- or higher on the final exam of each of the four Core Climate courses. Students who have taken the equivalent of any of these courses must take the Core course's final exam even if they do not take the course.

Qualifying Exams

Students take a qualifying exam by enrolling in CLIM 997 Doctoral Qualification. Students pass the exam by demonstrating an ability to analyze scientific problems, identify an open scientific question in climate dynamics, and outline a methodology to answer the question.

Students take CLIM 997 in their second spring semester in the program. Students who enter in the spring have the option of taking it in their 2nd or 3rd spring semester.

Code	Title	Credits
CLIM 997	Doctoral Qualification	3
Total Credits		3

Advancement to Candidacy

After the student has completed all coursework in CLIM 997 Doctoral Qualification, the Climate Dynamics Program Director decides whether the student continues in the doctoral program, based on performance in CLIM 997 and consultation with student's advisor and the instructors

of CLIM 997 and Core Climate courses. If the Director decides that the student can continue in the doctoral program, then the student forms a dissertation committee by the end of the following summer and thereafter enrolls in CLIM 998 Doctoral Dissertation Proposal.

Students who continue in the doctoral program are expected to submit a paper to a peer-reviewed journal, and to the dissertation committee, before the start of the Spring semester following the successful completion of CLIM 997 Doctoral Qualification. If this deadline is not met, then the student submits a progress report to the dissertation committee at the end of each semester until the paper is submitted. In all cases, a student must satisfy the submission requirement before submitting and defending a dissertation proposal.

By the end of the student's third year, the student should aim to present a Dissertation Proposal to their dissertation committee. If this deadline is not met, then the student convenes their thesis committee towards the end of their third year and presents a progress report. By the end of the student's fourth year, the student is expected to present a Dissertation Proposal to their thesis committee.

Once a dissertation committee approves the dissertation proposal and the student completes all non-dissertation program requirements, the student is formally advanced to doctoral candidacy and enrolls in CLIM 999 Doctoral Dissertation. Note that Doctoral students are expected to advance to candidacy within no more than six (6) years (AP.6.10.1 Time Limit (<https://catalog.gmu.edu/policies/academic/graduate-policies/>)).

Dissertation Research and Defense

After advancement to doctoral candidacy, the student works on the dissertation while taking CLIM 999 Doctoral Dissertation. The student is expected to meet and present a progress report with their committee once a year while taking CLIM 999 Doctoral Dissertation. The degree's requirements will be fulfilled upon completion of the required coursework and approval of a dissertation that makes an original and significant contribution to the field. For both full-time and part-time students enrolled in doctoral programs, whether entry is post-baccalaureate or post-master's, the total time to degree will not exceed nine (9) calendar years from the time of first enrollment in the program as a doctoral student (AP.6.10.1 Time Limit (<https://catalog.gmu.edu/policies/academic/graduate-policies/>)).

No more than 21 combined credits from CLIM 998 Doctoral Dissertation Proposal and CLIM 999 may be applied toward satisfying doctoral degree requirements, with no more than 18 credits of CLIM 998.

Code	Title	Credits
Choose credits for the following courses in consultation with an advisor:		21
CLIM 998	Doctoral Dissertation Proposal	
CLIM 999	Doctoral Dissertation (minimum 3 credits)	
Total Credits		21